AIR QUALITY

SUB-ELEMENT OF THE GENERAL PLAN

CITY OF SUNNYVALE

The Sub-Element complies with California Government
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City of Sunnyvale
Air Quality Sub-Element
of the General Plan

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PREFACE

This Air Quality Sub-Element establishes a policy framework to reduce air pollutant emissions from existing sources in Sunnyvale, lessen the emissions associated with future development, and reduce the exposure of residents to unhealthful levels of air contaminants. In recent years, increasing attention has been given to the influence of local policies regarding air quality and related policies concerning land use, community design and transportation.

The impetus for adopting an Air Quality Sub-Element comes from the California Clean Air Act and the regional plan mandated by that legislation. The Bay Area '91 Clean Air Plan adopted the use of air quality elements for cities and counties as a Transportation Control Measure and also includes an Indirect Source Control program. The delegation of authority to cities to implement the Indirect Source Control program would be dependent on the City having an Air Quality Element (or Sub-Element) within its General Plan.

The adoption of the Air Quality Sub-Element fulfills the requirements of the California Clean Air Act and the regional air quality plan. This Sub-Element would formalize Sunnyvale's policy to protect the environmental quality of Sunnyvale and the larger Bay Area by promoting community development which is compatible with air quality standards and minimizing the impact of future development on air quality. The Air Quality Sub-Element allows the City to address more comprehensive solutions to cumulative impacts on air quality early in the planning process. To solve air pollution and congestion problems, fundamental changes in land use and travel patterns are necessary because motor vehicles and stationary sources are already being regulated with the most up-to-date pollution control devices, though new state requirements on alternative fuels will provide further reductions in vehicle emissions. At stake are not only federal funds, but also human health, economic prosperity, and the overall quality of life.

The Air Quality Sub-Element is a new sub-element of the Environmental Management Element of the City's General Plan. The other sub-elements of the Environmental Management Element include Water Resources, Sanitary Sewer System, Surface Runoff, Energy and Noise. With careful management and planning, the City of Sunnyvale can preserve its environment and natural resources.

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Introduction

All major urban areas in California, including Sunnyvale, experience some degree of reduced air quality. The combination of climatic conditions and a multitude of air pollutant sources (particularly the automobile) results in reduced air quality, which can be considered as reducing the quality of life by adversely affecting human health, causing damage to plants or crops, and other effects such as soiling, visibility reduction and accelerated corrosion of materials.

Federal, state and local governments have made concerted efforts over the past 20 years to improve air quality. These attempts have consisted mainly of applications of new technology to control the rate of emissions. Examples are scrubbers for industrial sources and catalytic converters on automobiles. These efforts have resulted in a gradual improvement in air quality over the past twenty years despite increases in population. Violations of ambient air quality standards still occur in the Bay Area, however.

One of the major reasons that air quality continues to be a problem in the Bay Area specifically and California in general, is a relatively high rate of population and economic growth. The major obstacle to improved air quality in the future is increasing population and vehicle use and deteriorating operating conditions on highways and roads.

The most efficient and cost-effective technological or "hardware" controls have already been implemented. Remaining technological controls, which are increasingly expensive, have been found to be unable to reduce emissions to the point where all air quality standards would be met. Therefore, attention has been focused in recent years on the relationship of land use, community design and transportation as a means of reducing air pollutant generation.

The concept of an Air Quality Element or Sub-Element within a General Plan is rather recent, and is a natural outgrowth of the relationship between land use, transportation and air quality. This approach has recently gained favor as a means of addressing the basic problems of growth and its cumulative effect on local and regional air quality. The extent that future growth affects air quality will be partially determined by the form that new land uses take, and the transportation options available to new residents.

Purpose

The adoption of an Air Quality Sub-Element would clearly state Sunnyvale's policy to protect the health, safety, welfare and environmental quality of Sunnyvale and the larger Bay Area. The Sub-Element would promote community development that is compatible with air quality standards, minimizing the impact of future development on air quality.

In a larger sense, an Air Quality Sub-Element is part of the regional strategy for improving air quality. While air quality is often regarded as a regional problem, local land use and growth decisions by cities and counties will affect the success of whatever technology is available regionally to combat air pollution. The **Bay Area Air Quality Management District** (BAAQMD) has adopted a resolution urging cities and counties within the nine-county Bay Area to adopt Air Quality Elements[1], and the adoption of Air Quality Elements by cities is a major element of the Bay Area Air Quality Management District's indirect source program within the Bay Area '91 Clean Air Plan.

Major Findings

The following major findings are derived from information presented within the Air Quality Sub-Element. These findings form the basis of the goals and policies which follow.

1. Past efforts by federal, state and local governments have resulted in steady, gradual improvement in air quality in Sunnyvale and the greater Bay Area. The City of Sunnyvale has implemented a number of programs that directly or indirectly reduce air pollutant emissions.

2. Despite considerable improvement in air quality over a period of 20 years, air quality in Sunnyvale and the greater Bay Area still does not meet all ambient air quality standards, and the latest projections do not show attainment of all ambient air quality standards by the year 2000.

3. Although Sunnyvale is a "mature" community, potential future growth in population and employment could have a substantial effect on future air quality.

4. Sunnyvale contains numerous sources of Toxic Air Contaminants and numerous "sensitive receptors"; special attention to site planning is needed to reduce exposure of residents to these pollutants.

5. Indirect source controls (site planning, land use or transportation strategies to reduce vehicle trip generation) will become increasingly important in the future. Implementation of indirect source controls on the local level is an integral part of regional programs such as the Bay Area '91 Clean Air Plan and the county Congestion Management Program.

[1] Bay Area Air Quality Management District, Resolution Number 1666, May 21, 1986

Summary of Goals and Policies

This section is a summary of the goals and policies contained in this Sub-Element. Detailed goals and policies and supporting action statements are listed in body of the Sub-Element.

Goal A: Improve Sunnyvale's Air Quality and Reduce the Exposure of its Citizens to Air Pollutants

Policy A.1: Require all new development to utilize site planning to protect citizens from unnecessary exposure to air pollutants.

Policy A.2: Reduce automobile emissions through traffic and transportation improvements. Since traffic congestion delays increase the level of emissions, congestion management has air quality benefits.

Goal B: Reduce Air Pollution Impacts from Future Development

Policy B.1: Utilize land use strategies to reduce air quality impact.

Policy B.2: Assist employers in meeting the requirements of the Transportation Demand Management (TDM) plans for existing and future large employers, and explore requiring TDM plans for employment centers in Sunnyvale.

Goal C: Make a Contribution Towards Improving Regional Air Quality

Policy C.1: The City should actively participate in regional air quality planning.

Policy C.2: Improve opportunities for citizens to live and work in close proximity.

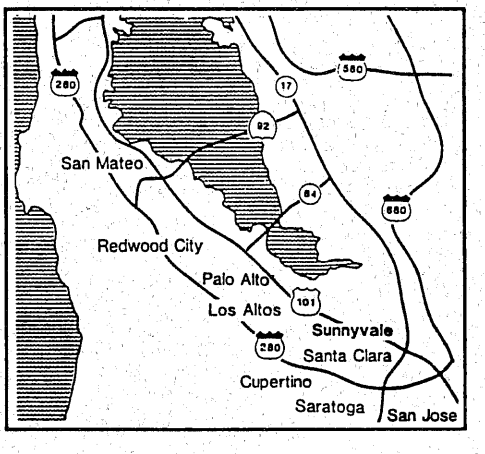
Policy C.3: Contribute to a reduction in Regional Vehicle Miles Travelled.

Policy C.4: Reduce Emissions from City of Sunnyvale fleet vehicles

COMMUNITY CONDITIONS

Air Pollution Climatology

The amount of a given pollutant in the atmosphere is determined by the amount of pollutant released and the atmosphere's ability to transport and dilute the pollutant. The major determinants of transport and dilution are wind, atmospheric stability, terrain and, for photochemical pollutants, sunshine.



Northwest winds and northerly winds are most common in Sunnyvale, reflecting the orientation of the Bay and the San Francisco Peninsula. Winds from these directions carry pollutants released by autos and factories from upwind areas of the Peninsula towards Sunnyvale, particularly during the summer months. Winds are lightest on the average in fall and winter. Every year in fall and winter there are periods of several days when winds are very light and local pollutants build up.

Pollutants can be diluted by mixing in the atmosphere both vertically and horizontally. Vertical mixing and dilution of pollutants is often suppressed by inversion conditions, when a warm layer of air traps cooler air close to the surface. During the summer, **inversions**[2] are generally elevated above ground level, but are present over 90 percent of the time in both the morning and afternoon. In winter, surface-based inversions dominate in the morning hours, but frequently dissipate by afternoon.

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2 Words included in the Glossary (Appendix A) are shown in bold type the first time they appear.

Topography can restrict horizontal dilution and mixing of pollutants by creating a barrier to air movement. While Sunnyvale itself has relatively flat terrain, the larger south bay sub-air basin has significant terrain features that affect air quality. The Santa Cruz Mountains and Hayward Hills on either side of the south bay tend to restrict horizontal dilution, and this alignment of the terrain also channels winds from the north to south, carrying pollution from the northern Peninsula towards Sunnyvale.

The combined effects of moderate ventilation, frequent inversions that restrict vertical dilution and terrain that restricts horizontal dilution give Sunnyvale a relatively high atmospheric **pollution potential**.

Air Pollution Standards

The Mulford-Carrell Act of 1969 and the Clean Air Act of 1970 established state and federal **air quality standards** for several pollutants. These standards are divided into primary standards, designed to protect the public health, and secondary standards, intended to protect the public welfare from effects such as visibility reduction, soiling, nuisance and other forms of damage. The state and federal standards are summarized in Figure 1.

The pollutants covered under the above-described legislation are known as **criteria pollutants** because the health and other effects of each pollutant are described in criteria documents. Another group of substances known as **Toxic Air Contaminants** (TACs), are injurious in small quantities and are regulated despite the absence of criteria documents. The identification, regulation and monitoring of TACs is relatively recent compared to that for criteria pollutants.

FIGURE 1

FEDERAL AND STATE AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time[3]	Federal Primary Standard[4]	State Standard[5]
Ozone	1-Hour	0.12 PPM	0.09 PPM
Carbon Monoxide	8-Hour	9.0 PPM	9.0 PPM
	1-Hour	35.0 PPM	20.0 PPM
Nitrogen Dioxide	Annual	0.05 PPM	---
	1-Hour	---	0.25 PPM
Sulfur Dioxide	Annual	0.03 PPM	---
	24-Hour	0.14 PPM	0.04 PPM
	1-Hour	---	0.25 PPM
Particulates	AGM	50 ug/m3	30 ug/m3
	24-Hour	150 ug/m3	50 ug/m3
Lead	30-Day	---	1.5 ug/m3
	3-Month	1.5 ug/m3	---

PPM = Parts Per Million ug/m3 = Micrograms Per Cubic Meter

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[3] The state and federal ambient air quality standards are based on exposure, which consists of both an average concentration and duration. The averaging time is the specified time period that concentrations are to be averaged.

[4] The levels of air quality necessary, with an adequate margin of safety to protect the public health. The national secondary standards are designed to protect public welfare from non-health effects.

[5] Specified concentrations and durations of air pollutants which reflect the relationship between the intensity and composition of air pollution to undesirable effects established by the California Air Resources Board.

The criteria pollutants and their effects are described below. California state standards are in general more restrictive than the corresponding federal standard, particularly for ozone and PM-10.

Ozone

Ozone is the most prevalent of a class of photochemical oxidants formed in the urban atmosphere, often referred to as **photochemical smog**. The creation of ozone is a result of complex chemical reactions between hydrocarbons and oxides of nitrogen in the presence of sunshine. Unlike other pollutants, ozone is not released directly into the atmosphere from any sources. The major sources of oxides of nitrogen and reactive hydrocarbons, known as **ozone precursors**, are combustion sources such as factories and automobiles, and evaporation of solvents and fuels.

Ozone near the ground is an air pollutant. The same chemical in the stratosphere, about 10 miles above the earth's surface, plays a beneficial role in protecting us from excessive ultraviolet radiation. Surface ozone and stratospheric ozone are independent phenomena.

The known health effects of ozone are eye irritation and damage to lung tissues. Ozone also damages some materials such as rubber, and may damage plants and crops.

Carbon Monoxide

Carbon monoxide is an odorless, colorless gas that is highly toxic. It is formed by the incomplete combustion of fuels, and its main source in the Bay Area is automobiles.

Carbon monoxide's health effects are related to its affinity for hemoglobin in the blood. At high concentrations, carbon

monoxide reduces the amount of oxygen in the blood. This deprivation causes heart difficulties in people with chronic diseases, reduces lung capacity and impairs mental abilities.

Nitrogen Dioxide

Nitrogen dioxide is a reddish-brown toxic gas. It is one of the oxides of nitrogen that result from combustion. It is the only oxide of nitrogen which is toxic; however, other oxides of nitrogen, particularly nitric oxide, are converted to nitrogen dioxide in the presence of sunshine. Major sources of oxides of nitrogen are automobiles and industry.

Nitrogen dioxide reduces visibility and is a pulmonary irritant.

Sulfur Dioxide

Sulfur dioxide is a colorless gas with a pungent, irritating odor. It is created by the combustion of sulfur-containing fuels. This substance is known to oxidize to sulfur trioxide, which combines with moisture in the atmosphere to form a sulfuric acid mist.

Sulfur dioxide damages and irritates lung tissue, and accelerates corrosion of metals.

Suspended Particulate Matter (PM-10)

Suspended particulate matter consists of solid and liquid particles of dust, soot, aerosols and other matter which are small enough to remain suspended in the air for a long period of time. A portion of the suspended particulate matter in the air is due to natural sources such as wind blown dust and pollen. Man-made sources include combustion, automobile exhausts, field burning, factory emissions and travel on both paved and unpaved roads. A

portion of the particulate matter in urban atmospheres is also a result of photochemical processes.

The ambient air quality standards are for suspended particulate matter less than 10 microns in diameter, designated PM-10. The known effects of high concentrations on humans include aggravation of chronic disease and heart/lung disease symptoms. Non-health effects include reduced visibility and soiling of surfaces.

Current and Past Air Quality in Sunnyvale

Sunnyvale is within the Bay Area Air Quality Management District (BAAQMD). The BAAQMD operates a network of monitoring sites throughout the Bay Area, but none are located within Sunnyvale. The closest multi-pollutant monitoring sites are located in downtown San Jose and Redwood City, and a single-pollutant monitoring site is located in neighboring Mountain View. Figure 2 below shows air quality data for criteria pollutants from these sites for 1989 to 1991.

The major air quality problems in the Bay Area are ozone, carbon monoxide and PM-10. The Bay Area is a **nonattainment area** for these three pollutants both under the state and federal air quality programs.

FIGURE 2

SUMMARY OF AIR QUALITY DATA FOR THE SOUTHERN PENINSULA, 1989-1991

Pollutant	Standard	Location	Number of Annual Exceedances: 1989	1990	1991
Ozone	Fed. 1-hour	San Jose	1	0	0
		Redwood City	0	0	0
		Mountain View	0	0	0
	State 1-hour	San Jose	9	4	6
		Redwood City	1	0	0
		Mountain View	6	1	3
PM-10[6]	Fed. 24-hour	San Jose	0	0	1
		Redwood City	0	0	0
	State 24-hour	San Jose	15	9	10
		Redwood City	10	8	12
Carbon Monoxide	Fed. 8-Hour	San Jose	6	2	4
		Redwood City	0	0	0
Nitrogen Dioxide	State 1-hour	San Jose	0	0	0
		Redwood City	0	0	0

[6] Samples of suspended particulates are taken every sixth day. The data shown is the number of samples exceeding the federal or state 24-hour standard for PM-10.

Figure 3 shows ozone air quality data for south bay monitoring sites over the 9-year period 1983 to 1991, in terms of the number of days above the state standard each year. Over this period wide variations are evident, related to climatic variation (ozone levels tend to be higher than average when summer temperatures are higher than average, and vice-versa). The overall trend during this period is downward in response to a gradual decrease in the region-wide emission of ozone precursors, but violations of the standard still occur. A general north-to-south deterioration in air quality is also evident from Redwood City to San Jose.

Figure 4 shows air quality data for carbon monoxide for Redwood City and San Jose in terms of the number of days exceeding the 8-hour carbon monoxide standard per year for the period 1983-1991. As with ozone, year-to-year variations are evident related to weather, but a general downtrend is evident.

Figure 5 shows annual exceedances of the state 24-hour PM-10 standard for the period 1986-1991. PM-10 was not measured prior to 1986. A downward trend is evident during this period, but less pronounced than for ozone or carbon monoxide.

Regional Air Quality Planning

Attempts to combat air quality problems began at the federal level with the enactment of the Clean Air Act of 1967. Initial efforts included the establishment of national ambient standards, designation of local air pollution control districts and creation of an air quality monitoring network.

FIGURE 3

SOUTH BAY OZONE AIR QUALITY, 1983-1991

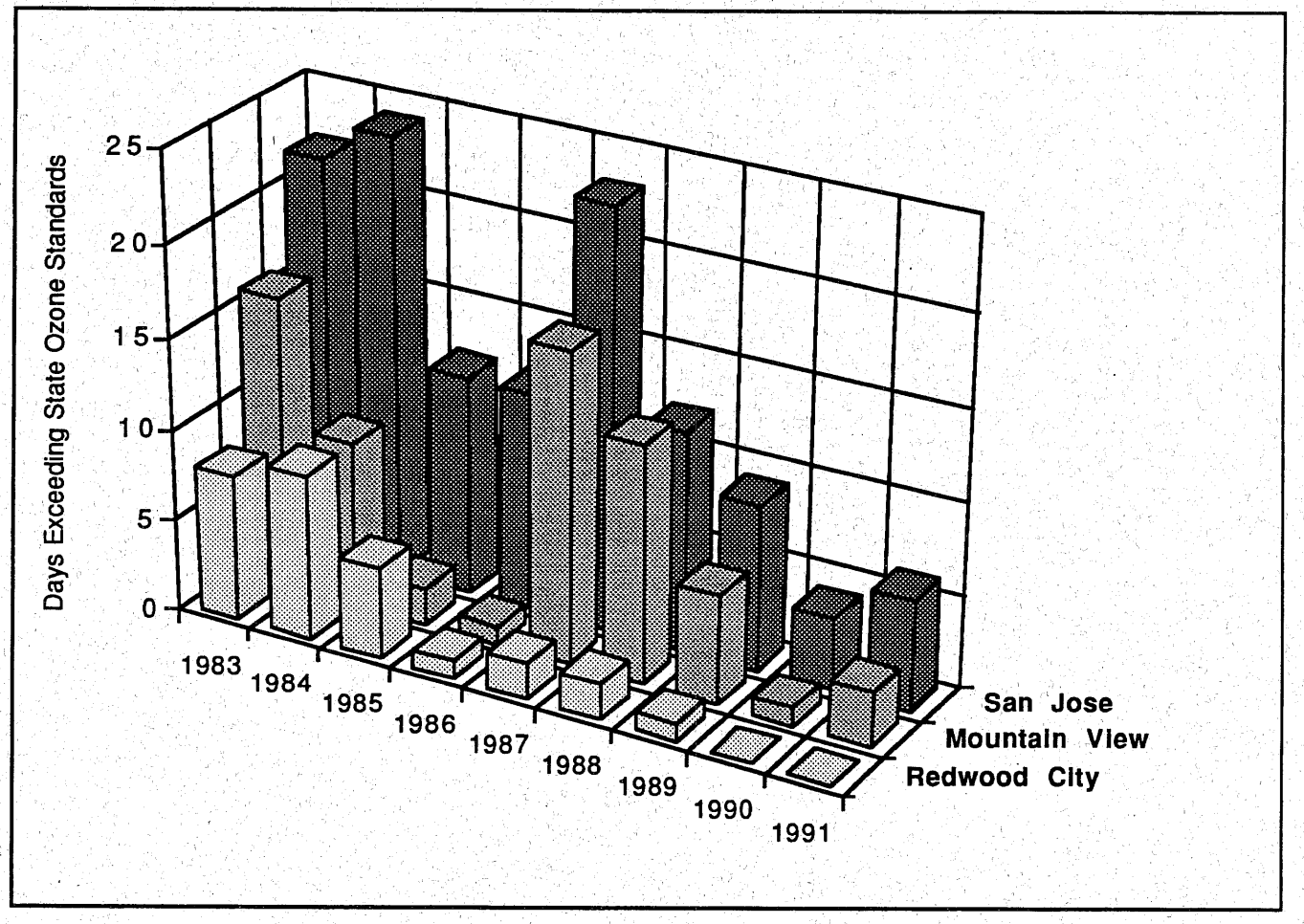


FIGURE 4

SOUTH BAY CARBON MONOXIDE AIR QUALITY, 1983-1991

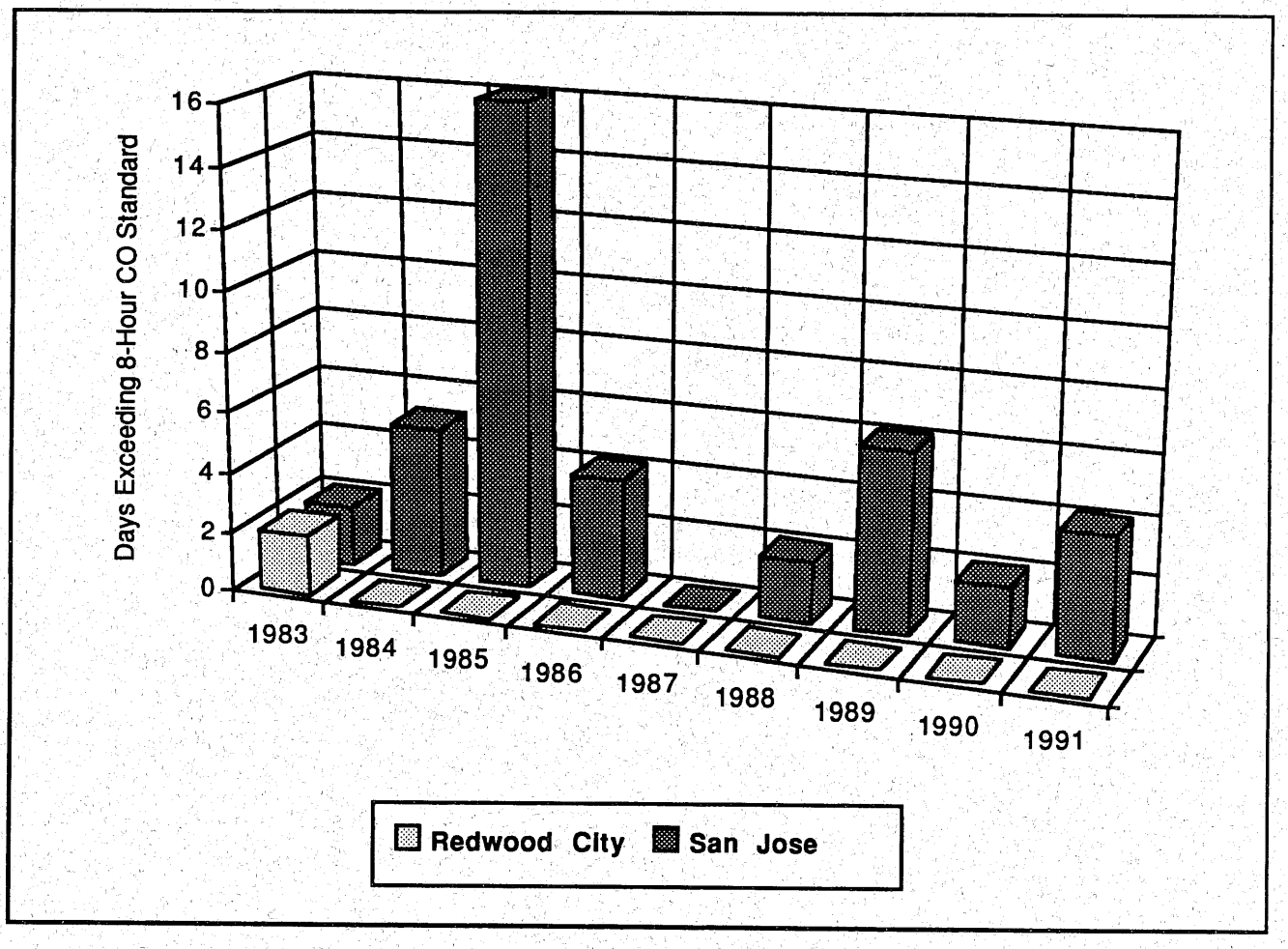
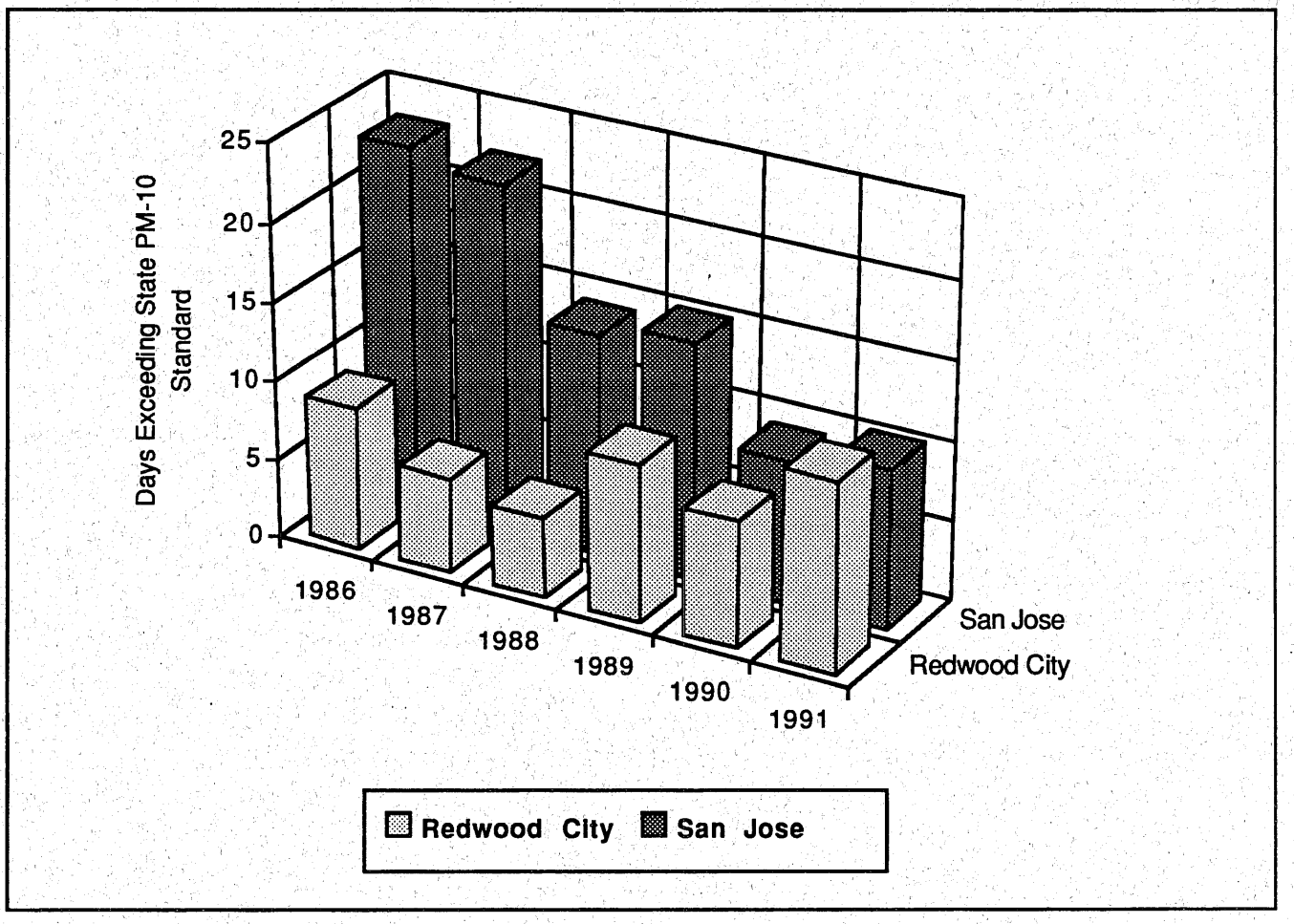


FIGURE 5

SOUTH BAY PM-10 AIR QUALITY, 1986-1991



Over the last 20 years, state and local agencies have adopted regulations on a multitude of air pollutant sources. After obvious and major sources of pollution were controlled (factories, automobiles) controls were implemented on smaller sources (gasoline vending, and solvent-based paints for example).

While the state ambient air quality standards have existed for many years, no state legislative requirement that they be attained existed when the **California Clean Air Act of 1988** was enacted.

Federal Program

The U.S. Clean Air Act Amendments of 1977 required that each state identify areas within its borders that did not meet federal primary standards as non-attainment areas. The states were required to prepare a State Implementation Plan (SIP) to show how the federal standards were to be attained by 1987. The Bay Area portion of the SIP was the 1982 Bay Area Air Quality Plan. Despite considerable improvement in air quality, the Bay Area did not meet the 1987 deadline for attainment of the federal air quality standards.

The federal Clean Air Act Amendments of 1990 require that nonattainment areas develop plans and strategies that will reduce pollutants by 15% during the first 6 years, then 3% annually thereafter until the standards are met. The schedule for attainment is different for different pollutants and depends on the severity of the problem. Failure to meet the requirements of the federal Clean Air Acts could result in the imposition of sanctions (e.g. withholding of highway project funding).